(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number : **0 604 946 A1**

(12) EUROPEAN PATENT APPLICATION

(21) Application number : **93120955.5**

(51) Int. Cl.[5] : **G01C 21/20**, G11B 27/32

(22) Date of filing : **27.12.93**

(30) Priority : **30.12.92 JP 360202/92**

(43) Date of publication of application :
06.07.94 Bulletin 94/27

(84) Designated Contracting States :
DE FR GB

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(54) Optical disc for a vehicle navigation system having both a read-only area and a userwritable area.

(57) In a composite disc (7) having a read-only area (30) and a recordable area (31), user data corresponding to map information which has been preliminarily recorded in the read-only area (30), is recorded to the recordable area (31). A large volume of user data can be stored without provision of a back-up power source.

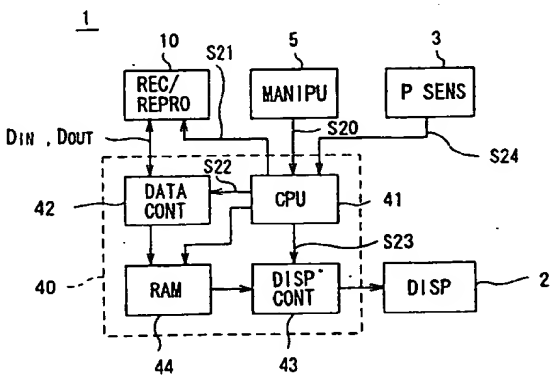

FIG. 6

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BACKGROUND

1. Field of the Invention

The present invention relates to a navigation system for using a recordable recording medium and a recording and/or reproducing method of the navigation system. More particularly, the present invention relates to a navigation system for detecting, for example, a positional information of a vehicle, and a recording medium for recording such detected information.

2. Background of the Invention

Heretofore, in a navigation system to be mounted on a vehicle, a map information recorded on a CD-ROM (compact disc read-only memory) consisting of an optical disc is read by an optical pick-up to display on a monitor, on the map displayed on which the present position of the vehicle and the like, whose information is received from an artificial satellite, are indicated.

Such a navigation system is known by, for example, U.S. Patent No. 4, 571, 684.

However, in the navigation system of this type, since its CD-ROM disc is large in diameter, there is a problem that a reproducing unit for reading the recorded information on the CD-ROM becomes large, too.

Because of this reason, it is necessary to install the reproducing unit in a location remote from the driver such as, for example, in the trunk or under the seat. This is very troublesome for the driver when a requirement for replacing the CD-ROM occurs.

Moreover, since the CD-ROM is a recording medium for a read-only operation, the user cannot record any data on the recording medium.

On the contrary, as a recording medium which can be recorded by the user, it is known that information is memorized to a rewritable semiconductor memory.

However, there is a problem that an amount of information which can be stored in the memory is limited. Also, there is another problem that when the user stores the user data in the memory contained in the system body, the data is stored in a manner unrelated to the CD-ROM and therefore it becomes difficult for the user to judge which data in the memory corresponds to which CD-ROM.

There is still another problem that in order to maintain the information stored in the memory, a provision of a back-up power source becomes absolutely necessary. In the navigation system to be mounted on a vehicle, there is a problem that the battery is wasted.

Besides the above, there is another conventional device in which user data of the navigation system is recorded on a card-like recording medium. However, this recording medium is not yet satisfactory in view of its recording capacity.

Further, the device must be provided the driving unit of the CD-ROM and that of the card-like recording medium both. There is a problem that down-sizing of the entire system.

SUMMARY OF THE INVENTION

It is, therefore, an object of the present invention to provide a recording medium used a navigation system which resolves the above-mentioned problem.

It is another object of the present invention to provide a navigation system for using a recordable recording medium which resolves the above-mentioned problem.

It is further object of the present invention to provide a recording and/or reproducing method of a navigation system.

According to the present invention, there is provided a recording medium, in which: a first area which has been preliminarily recorded a map information is formed; a first management area for recording information which manages the above map information recorded in the first area is formed on a part of the above first area; second area which is recordable is formed; a second management area for recording information which manages the map information recorded in the first area is formed a part of the above second area; the first and second management areas are enabled to associated with each other, in order that the map information recorded in the first area and the information to be recorded in the second recording area are enable to correspond to each other.

According to the present invention, there is provided a navigation system comprises: a position sensor for detecting a present position information upon receipt of a radio wave from a satellite; recording and/or reproducing means for reproducing a map information which has been preliminarily recorded on an magneto-optical disc and user data which has been recorded by the user, and recording a predetermined user data on the magneto-optical disc; navigation control means for calculating the present position in accordance with a position information signal outputted from the position sensor and controlling the recording and/or reproducing means; display means for displaying a predetermined image thereon in accordance with a reproducing signal obtained from the recording and/or reproducing means and the position information signal obtained from the navigation control means; and a manipulation part for selecting desired modes of the recording and/or reproducing means and the navigation control means, respectively.

According to the construction so far described, by using a magneto-optical disc including both a

read-only area in which a predetermined map data has been preliminarily recorded and a recordable recording and reproducing area , the user can write a desired user data corresponding to the map data in the recording and reproducing area. Thus, there can be realized a navigation system which is markedly improved in easiness of use.

Furthermore, owing to the arrangement in that the user data is recorded on the recordable magneto-optical disc, the user data can be reserved without a provision of a back-up power source.

Moreover, owing to the arrangement in that there is employed such a small-sized magneto-optical disc as having a diameter of 64 (mm) for recording a map information and a user data, there can be realized a navigation system which is markedly small in size compared with the conventional systems.

BRIEF DESCRIPTION OF THE DRAWING

The invention will be more readily understood with reference to the accompanying drawing, wherein:

Fig. 1 is a schematic diagram showing one embodiment of a navigation system of the present invention.

Fig. 2 is a block diagram showing a construction of a recording and/or reproducing unit.

Fig. 3 is a schematic diagram showing a data construction for a magneto-optical disc.

Fig. 6 is a block diagram showing the navigation system.

Fig. 5 is a schematic diagram illustrating the data structure of a management information (UTOC) of a recording and reproducing area.

Fig. 4 is a schematic diagram showing a corresponding table designating data and a management table in detail.

Fig. 7 is a flow chart showing the processing procedure of a navigation system.

Fig. 8 is a schematic diagram explaining a running locus and a user's symbol.

Fig. 9 is a schematic diagram showing another embodiment of a magneto-optical disc.

DESCRIPTION OF THE Invention

Preferred embodiments of this invention will be described with reference to the accompanying drawings.

(1) General Construction

Fig. 1 shows a navigation system in general. In a navigation system 1, a positional data obtained by a position sensor 3 is input into a system main portion 2 containing a navigation computer.

The position sensor 3 receives position information signals from an artificial satellite and the navigation computer calculates the present position of the vehicle in accordance with such received signals.

A display screen 4 and manipulation elements 5A, 5B and 5C are arranged on a front surface of the system main portion 2. Various kinds of information including positional information, which are obtained by the navigation computer, are displayed on the display screen 4. The mode of the navigation computer is switched into various ways by the user's manipulation of the manipulation parts 5A to 5C.

Further, an insertion slot 6 for a recording medium is formed in a side surface of the system main portion 2. A magneto-optical disc 7 having a diameter of 64 mm contained in a disc cartridge is inserted through the insertion slot 6.

The system main portion 2 contains a recording and/or reproducing unit for reproducing the information recorded on the magneto-optical disc 7 and recording a predetermined information on the magneto-optical disc 7.

The navigation system 1 is capable of displaying the information recorded on the magneto-optical disc 7 on the display screen 4 and recording a desired information on the magneto-optical disc 7.

Here, the magneto-optical disc 7 has a recording capacity of approximately 200 Mbyte. This arrangement makes it possible for the user to write on the magneto-optical disc 7 a markedly large volume of information compared with the conventional storage means such as a RAM (random access memory), or the like.

In the navigation system 1, owing to such an arrangement that the predetermined information can be recorded on and reproduced from the magneto-optical disc having a diameter of 64 mm, a markedly large volume of information can be recorded thereon without a provision of a back-up power source compared with the conventional case, and the system itself can be made compact in size.

Further, in this navigation system 1, when the system 1 is to be mounted on a vehicle, the system main portion 2 can be located at a front surface of a front panel in the vicinity of the driver's seat. It can also be used as a portable or hand-carrying device.

(2) Recording and/or Reproducing Unit

Fig. 2 shows the recording and/or reproducing unit 10 built in the system main portion 2.

In the recording and/or reproducing unit 10, the magneto-optical disc 7 having a diameter of 64 mm is rotationally driven by a spindle motor 11.

In the recording and/or reproducing unit 10, by applying a modulated magnetic field corresponding to the recording data to the magneto-optical disc 7 through actuation of a magnetic head 14 when optical beam is being radiated to the magneto-optical

disc 7 from a light emitting/receiving portion 13 of an optical head 12, the recording data is thermomagnetically recorded by means of the application of a magnetic modulation recording system, thereby recording a data DIN input from an external device along a recording track on the magneto-optical disc 7.

In the recording and/or reproducing unit 10, light beam is radiated from the light emitting/receiving portion 13, from which a reproducing signal S1 is supplied to a high-frequency amplifier 15 as an output corresponding to its reflected light.

The high-frequency amplifier 15 extracts a reproducing high-frequency signal S2, a tracking error information S3, a focus error signal S4, an absolute position information S5, an address information S6, a sub-code information S7, a focus monitor signal S8, etc. and converts the reproducing high-frequency signal S2 in a binary format in order to supply it to a decoder 17. The amplifier 15 also supplies the address information S6 to an address decoder 18.

The high-frequency amplifier 15 supplies the tracking error signal S3 and the focus error signal S4 to a servo circuit 19, and also supplies the focus monitor signal S8 to a system controller 20.

The servo circuit 19 sends servo driving signals S10 and S11 respectively to the spindle motor 11 and the light emitting/receiving portion 13 in accordance with the tracking error signal S3, the focus error signal S4, and a seek command S12 from the system controller 20, in order to effect a spindle controlling, a tracking controlling, and a focusing controlling.

Also, the servo circuit 19 sends a drive signal S12 to a thread control circuit 21 to move the optical head 12 and the magnetic head 14 onto a targeted recording track.

The servo circuit 19 outputs the information S13 representative of the operating conditions of various parts such as the focus control circuit, etc. to the system controller 20, so that the operating conditions can be recognized by the system controller 20.

Here, a recording system of the recording and/or reproducing unit 10 inputs digital signals DIN sent from the navigation computer to a signal processing section 16 through a memory controller 22 in order.

The encoder 23 performs an encoding processing or procedure (adding of parity codes and interleave processing) in order to correct errors, and then performs an EFM (eight fourteen modulation) encoding processing or procedure.

Such encoded digital data S14 in accordance with a recording format of the magneto-optical disc 7 in the encoder 23 is supplied to a magnetic head driving circuit 24 to actuate the magnetic head 14, thereby forming a modulated magnetic field corresponding to the data 14 to be recorded.

Simultaneously, the system controller 20 controls the action of the signal processing portion 16, and also the positions of the optical head 12 and magnetic head 14, thereby continuously recording the digital data in predetermined recording tracks.

In a reproducing system of the recording and/or reproducing unit 10, the decoder 17 of the signal processing section 16 receives binary data outputted from the high-frequency amplifier 15 and effects an EMF demodulation processing and an error correction processing.

At this time, the decoder 17 temporarily stores the reproduced data in a memory (RAM) 25 and reads the reproduced data from the RAM 25 in order to carry out the above processing.

Thereafter, the recording and/or reproducing unit 10 sends the digital data outputted from the decoder 17 to the navigation computer through the memory controller 22.

(3) Magneto-Optical Disc

As shown in Fig. 3, the magneto-optical disc 7 like a compact disc is of a composite disc structure, in which there are provided a read-only area 30 formed with a pit in which a predetermined information has been preliminarily recorded, and a recording and reproducing area 31 formed with a vertical magnetized film in which a desired data can be recorded and from which a desired data can be reproduced.

In the magneto-optical disc 7, a lead-in area 34 and a lead-out area 35 are formed respectively at the innermost periphery and outermost periphery.

In the lead-in area 34, management information representative of kind and the like for the magneto-optical disc 7 of this type are recorded.

This information managed in the lead-in area 34 is referred to as "PTOC" (Program Table of Contents).

In the lead-out area 35, various data as to represent the outermost periphery of the disc, end position of the recording area, etc., are recorded.

In the magneto-optical disc 7, a UTOC (User Table of Contents) area 32 is formed at an inner peripheral side of a recordable and/or reproducible recording and reproducing area such that the recorded data can be managed using this area.

The predetermined map data is preliminarily recorded in the read-only area 30. In the above PTOC, whether the map data is recorded from which address on the magneto-optical disc, is recorded.

The reproducing unit reads the PTOC data, and moves the optical head 12 to the physical position (address) on the magneto-optical disc thus designated by the PTOC data, to read the data.

This read data in which three-dimensional data regarding the position data on maps includes latitude, longitude, and height is memorized as a data table.

The respective latitude, longitude, and height is divided into a predetermined interval (for example, latitude and longitude are divided into an unit of sec-

ond, and height is divided into an unit of 300 (m)), thus the amount of data and its precision are determined in accordance with the divided width.

Moreover, in the above table, a file number which is recorded the map data corresponding to the respective position data, and an address data which is recorded on the magneto-optical disc, are recorded.

The above map data is composed of data of mesh into which the whole of map display is divided and the mesh is, for example, 300 (m) x 300 (m) area as one block. The file number and the data designated by the address data on the magneto-optical disc, are corresponding to one-block thus separated.

The data designated by the file number and the address data recorded on the magneto-optical disc, is composed of, for example, design information (color data), character information (character data of tourist information, latitude, longitude, height, etc., and mark representative building and the like), road information (display of one-way traffic, approach angle to crossroads, and data of distance to the next crossroads), etc..

Next, the recording and reproducing area 31 will be described below.

As described above, the UTOC area 32 is formed at the inner periphery side. The UTOC manages information which the user wants to add as a data. In the case where the user wants to read for example, symbol of arrow and so on, voice data, date, character data and the like, the UTOC preliminary manages each of that as individual file.

As shown in Fig. 4, the UTOC consists of a data area of 4 bytes x 587.

In the data area of Fig. 4, data which are composed of the sector using state, disc discriminating data, etc., are recorded at a predetermined address position succeeding to the header.

A designating data to corresponding table is also managed and the table records various table pointers (P-DFA to P-TNO255) corresponding to each file recorded on the magneto-optical disc.

In the above corresponding table designating data, a data designating the management table portion of Fig. 4 (in concrete, data of (01) to (FF)) is recorded.

Here, each management table of (01) to (FF) are referred to as "parts table".

The management table portion consists of start address and end address information which are absolute lot numbers on the magneto-optical disc, succeeding link information designating the parts table information representing whether or not prohibition on over-write and data-copy are set, and mode information representing whether or not being audio data and whether being monaural sound or stereo sound.

When the link data is not connected to any parts table, "00" is recorded. When the link data is connected to a parts table, a data which designates a position on the management table of the succeeding parts table (in concrete, data of (01) to (FF)) is recorded.

In the management table of Fig. 4, respective parts tables of (00) to (FF) are shown its content by table pointers of the corresponding table designating data (P-DFA, P-EMPTY, P-FRA, P-TNO1 to P-TMO255).

The table pointer P-DFA (Pointer for Defective Area) recorded in the area of Fig. 4 manages a defective area on the magneto-optical disc. In short, it manages an area on the magneto-optical disc which has defected area owing to scratch, finger mark, or the like as an unrecordable area.

If any defective areas are found on the magneto-optical disc disconnectly, these are connected by the link data.

On the other hand, if the other defective area is not found, the link data is set for example, "00", and set "no link" after it.

The table pointer recorded in the area of Fig. 5 P-EMPTY (Pointer for Empty Slot) designates the head of the unused parts tables on the management table. As shown in Fig. 4, since there are only 255 parts in the parts table, even if there is unrecorded area on the magneto-optical disc, it is impossible to record more than 255 parts.

For example, when 255 pieces of music being 10 seconds respectively are recorded to the magneto-optical disc which can record by 60 minutes, it represents that the optical disc is recorded during 10 x 255 = 2550 (sec) = 42 (min) 30 (sec). It means that it can still record by 17 (min) 30 (sec), however, because all parts table have been used- already, it cannot record more than this.

In another case, the above example premises that 1 piece of music is composed of 1 parts table, but as another case, if recording a piece of music divided into two parts on the magneto-optical disc separately, it cannot be recorded more than 123 pieces of music.

The table pointer P-FRA (Pointer for FREELY AREA) to be recorded in the area of Fig. 4 represents a data recordable area on the magneto-optical disc, and designates the head of parts table of parts which becomes a recordable area.

When there is a recordable area, one of (01) to (FF) is recorded to the table pointer P-FRA. When there are any recordable area, these are connected by the link data.

"(00)" is recorded to the end of the link data to set as "no link" on and after it.

Fig. 5 shows schematically the state of management of a segment being recordable area by the parts table.

This shows that, when each segment shown by parts tables (03), (18), (1F), (2B), and (E3) are set as recordable areas, the state is representing by the link data of the parts tables (03), (18), (1F), (2B), and (E3)

succeeding to the table pointer P-FRA.

Note that, also the above P-DFA, P-EMPTY, P-TNO1 to P-TNO255 have similar management forms.

On the other hand, this recording and reproducing area 31 is managed by the UTOC. For example, the user wants to record a symbol of an arrow or the like on the map data displayed now, the P-TNO1 is maintained as an area to be recorded an arrow data. Also, when the user wants to record a voice data, the P-TNO2 is maintained as an area to be recorded a voice data. At this time, a start address and an end address are maintained a predetermined length of address during recording.

As the above recording data, it is considered that symbol, voice, character data, date and time, image data etc., and the P-TNO is allocated to each of them, so that the start address and end address of the respective parts maintain the predetermined length of address.

In the above embodiment, each P-TNO maintains the predetermined length of address. However, if the above length of address has been used already, a recordable area is searched from the P-FRA to maintain new area and record thereto. At this time, it is apparent that this new parts table is connected by the link data.

Further, for example, if when searching a symbol data, the P-TNO1 is accessed, and the all of data recorded thereto are read, and then the address, the latitude, and the longitude corresponding to the map data reproduced from the present displayed read-only area 30, it takes a minutes.

Then, for example as the P-TNO, a group of data recorded to the recording and reproducing area 31 corresponding to the address of the read-only area 30 is registered as a file for search, so that it the search time is shortened.

In the case that the user supplements a new map data (a new road, a new bridge, or the like) to the map data which has been preliminarily recorded in the read-only area 30, the recording and/or reproducing unit 10 records the address of the original data corresponding to the supplementing data, kind of supplementing data (characters and lines), supplementing time, date, etc. in the recording and reproducing area 31 of the magneto-optical disc 7.

When the supplementing data are characters, the recording and/or reproducing unit 10 records the row of the code of each character and the latitude, longitude, and height data to the recording and reproducing area 31, and when the supplementing data are lines, the color, and the latitude and longitude of the starting point and the ending point of each line are recorded in the recording and reproducing area 31.

When recording the user's symbol on the magneto-optical disc, the recording and/or reproducing unit 10 records the latitude, longitude, and height of the place designated by the user in the recording and reproducing area 31, or the address, the time and the date of the map data at the place designated by the user in the recording and reproducing area 31.

In the magneto-optical disc 7, voice as well as the user's symbol can also be recorded by the recording and/or reproducing unit 10. In this case, it is good enough to record, as the recording data, for example, the latitude and longitude of the user's symbol, the recording data, and the starting/ending addresses for writing the recorded voice in the recording and reproducing area 31. By doing this, the user can record his/her own information in a certain place with ease and in detail.

In this way, the magneto-optical disc 7 can record various user data in its recording and reproducing area 31 in a manner as having a relationship or correspondence with the map data which has been preliminarily recorded in the read-only area 30. As a consequence, the map data which has been preliminarily recorded in the read-only area 30 can be displayed on the screen 4 in a manner as to correspond to the user data recorded in the recording and reproducing area 31.

In the case where the navigation system 1 includes a means for editing the user's symbol, the recording and/or reproducing unit 10 is designed such that in addition to the address, the time and the date, there can be recorded the information representative of the shape of the user's symbol in the recording and reproducing area 31. Similarly, in the case where the navigation system 1 includes a means for inputting an image, the recording and/or reproducing unit 10 is designed such that the image data can be recorded in the recording and reproducing area 31.

(4) Navigation Computer

As shown in Fig. 6, the navigation system 1 is designed such that upon receipt of a control signal S20 from a manipulation part 5, a CPU 41 of a navigation computer 40 sends control signals S21, S22, and S23 respectively to the data recording and/or reproducing unit 10, a data control unit 42, and a display control unit 43 in order to switch their modes in various ways and also receives a position information signal S24 from the position sensor 3 so as to temporarily store the position information signal S24 in a memory (RAM) 44, and thereafter the CPU 41 combines the map data and user data from the recording and/or reproducing unit 10 with the position information S24 so as to supply the combined data to the display screen 2 through the display control unit 43.

As shown in Fig. 7, when the CPU 41 of the navigation computer 40 is turned on, the program enters to step SP1 from step SP0, in which the control signal S20 coming from the manipulation part 5 is read, and then the program proceeds to step SP2 where the position information signal S24 coming from the pos-

ition sensor 3 is read.

Thereafter, the CPU 41 judges in step SP3 whether or not the mode for displaying the map moves together with the present position in accordance with the control signal S20 from the manipulation portion 5. If an affirmative result is obtained here, the program proceeds to step SP4.

In step SP4, the CPU 41 sends the control signal S21 to the recording and/or reproducing unit 10. By doing this, in the navigation system 1, the map data corresponding to the positional information from the position sensor 3 is read from the read-only area 30 of the recording medium 7 so as to display the map indicative of the present position and its neighborhood on the display screen 2 and also to display a mark 50 indicative of the present position on the map as shown in Fig. 8.

Thereafter, the CPU 41 judges in step SP5 whether or not it is the mode for displaying a locus in accordance with the control signal S20 from the manipulation part 5. If affirmative result is obtained here, the program proceeds to step SP6 where a running locus 51 (Fig. 8) up to the present position is displayed on the map which is already displayed on the screen 2.

In contrast, if a negative result is obtained in step SP5, the program returns to step SP1 where the CPU 41 reads the control signal S20 again from the manipulation part 5.

In step SP7, the CPU 7 judges where or not it is the mode for displaying the user's symbol in accordance with the control signal S20 from the manipulation part 5. If the mode for displaying the user's symbol is already set by the manipulation part 5, the CPU 41 displays a user's symbol 52 in step SP8 consisting of a flag mark, for example, on the display screen 2 as shown in Fig. 8.

That is, the navigation system 1 is designed such that, in step SP7, the map data is read from the read-only area 30 of the magneto-optical disc 7 by the recording and/or reproducing unit 10 and the user's symbol data where the address corresponding to that of the particular map data is written is read from the recording and reproducing area 31, and then these data are displayed on the display screen 2, respectively.

If the judgment in step SP3 is negative, the program proceeds to step SP9. In step SP9, the CPU 41 judges whether or not it is the mode for moving the place for looking the map though the manipulation of the manipulation part 5, in accordance with the control signal S20 from the manipulation part 5. In other words, it is judged whether or not it is the mode for searching a desired map. If the judgment result is affirmative here, the program proceeds to step SP10 where the map data are read one after another from the read-only area 30 of the magneto-optical disc 7 in accordance with the manipulation of the manipulation part 5, and the desired map is displayed on the display screen 2 by scrolling the map on the display screen 2.

In contrast, if the judgment result in step SP9 is negative, the program proceeds to step SP11 where the CPU 41 judges whether or not the mode set by the manipulation part 5 is the mode for inputting the user's symbol mark.

If the judgment result in step SP11 is affirmative, the program proceeds to step SP12 where the CPU 41 registers the user's symbol mark in place corresponding to the manipulation of the manipulation part 5. Thereafter, the program proceeds to step SP13 where the CPU 41 records the user's symbol on the magneto-optical disc 7.

That is, in the navigation system 1, the address of the user's symbol is recorded in the recording and/or reproducing area 31 in a manner as to correspond to the map data recorded in the read-only area 30 of the magneto-optical disc 7 in step SP13.

In contrast, if the judgment result in step SP11 is negative, the program proceeds to step SP14 where the CPU 41 judges whether or not the mode set by the manipulation part 5 is a mode for reserving the locus.

If the judgment result in step SP14 is affirmative, the program proceeds to step SP15 where the CPU 41 records the running locus on the magneto-optical disc 7.

That is, in the navigation system 1, the latitude, the longitude, the height, and the time and the date obtained by the position sensor 3 are recorded in the recording and/or reproducing area 31 of the magneto-optical disc 7 in step SP15.

In above step SP7, the embodiment only user symbol display mode is shown. However, this invention not only limited to this, but may display recorded date and time, voice data, image data in accordance with the manipulation part.

It is needless to say that, also in step SP11, it is corresponding to the input mode of recorded date and time, input mode of voice data, and the input mode of image data suitably, in accordance with the manipulation part.

(5) Operation of the Embodiment

A concrete reproducing method of device will be described below. For example, with respect to the latitude, longitude, and height which are detected by the position sensor 3 shown in Fig. 6, the CPU 41 reads and supplies a PTOC data to the recording and/or reproducing unit 10, to read the file number corresponding to the position data which is detected by the position sensor 3 from the above data table, and the address data recorded on the disc.

Next, the map data are read by accessing to the read file number and address data, and output it to a

data control part 42 as output data DOUT. The output data DOUT is temporarily stored to RAM 44, and then transmitted to a display control part 43 as a map data, thereby a map can be displayed on a display 2.

With the construction mentioned above, the navigation system 1 reads the map data from the read-only area 30 of the magneto-optical disc 7 and displays the map data on the display screen 2.

At this time, when the user sets the mode in various ways through manipulation of the manipulation part 5, the navigation system 1 performs the processing in accordance with this mode.

For example, when the user sets a mode for displaying the present position on the display screen 2, the mark 50 (in Fig. 8) indicative of the present position is displayed on the display screen 2 in accordance with the positional information from the position sensor 3.

When this mark 50 moves in accordance with motion of the vehicle, the navigation system 1 read the map data corresponding to the movement of the mark 50 one after another from the read-only area 30 and displays the same on the display screen 2.

When the user sets the mode for searching the desired map, the navigation system 1 reads the map data from the read-only area 30 of the magneto-optical disc 7 one after another in accordance with the user's manipulation of the manipulation part 5 and displays the same on the display screen 2.

When the user sets the mode for reserving the user's symbol 52 (in Fig. 8), the user displays the desired map on the display screen 2 through his/her manipulation of the manipulation part 5 in the same mode for searching the map. Thereafter, when the user designates a position on the map where the user's symbol 52 is to be set through his/her manipulation of the manipulation part 5, the navigation system 1 records the address of the read-only area 30 corresponding to the designated position or the latitude, longitude, and height of the designated position, the recording time, and the data in the recording and reproducing area 31 of the magneto-optical disc 7.

When the user sets the mode for reserving the locus, the navigation system 1 records the latitude, the longitude, the height, the time and the date obtained by the position sensor 3 in the recording and reproducing area 31 of the magneto-optical disc 7.

Let's presume here, for example, that the user drives a vehicle using the navigation system 1 as a device to be mounted on a vehicle and records the running locus to the destination at that time as well as the user's symbols indicative of the places to which attention should be paid, and the user decides to go to the same destination later again but by train this time, carrying the navigation system 1 with him or her. In this case, by using the map which was used when the user traveled by vehicle, as a portable one, there can be realized a visit to the same destination via the same route in spite of the fact that the later visit is made at an entirely different time and through a different transportation means.

Also, when, for example, the user preliminarily records at home the user's symbol in that place where the user wants to go using a navigation system 1 which is designed for home use, and the magneto-optical disc 7 on which the user's symbol now has been recorded is used in the navigation system 1 to be mounted on a vehicle, the user can easily go to the destination which has been preliminarily recorded at home.

Also, when, for example, the magneto-optical disc 7 on which the running locus, the user's symbol, etc. has been recorded by a first user, is used and reproduced by a second user in a different navigation system 1 which is mounted on a different vehicle, the second user can drive the vehicle with reference to the running locus, the user's symbol, etc. recorded by the first user.

Also, when it occurs that a new road is constructed, or the like, the user can prepare a new map by marking that road on the old map and recording this data in the recording medium. In this case, the new road or the like can easily be indicated on the old map by using such input means as, for example, a touch pen.

In the above embodiment, there has been described a case wherein the mode can be switched in various ways by the cursor type manipulating element 5C (Fig. 1). However, the manipulation means of the present invention is not limited to this. Alternatively, such manipulation means as a joy stick type manipulating element, a roller type manipulating element, a remote controller, or the like is likewise applicable.

Furthermore, in the above embodiment, there has been described a case wherein the magneto-optical disc 7 having a diameter of 64 (mm) is used. However, the present invention is not limited to this. Alternatively, magneto-optical discs having a wide range of sizes are likewise applicable.

Similarly, in the above embodiment, there has been described a case where a composite disc including the read-only area 30 formed with a pre-pit and the recordable recording and reproducing area 31 is used. However, the present invention is not limited to this. Otherwise, as shown in Fig. 9, there can be used a recording and/or reproducing disc having a vertical magnetized film formed on its entire surface, which is capable of recording/reproducing a desired data as a whole.

While there has been described in connection with the preferred embodiments of the invention, it will be obvious to those skilled in the art that various changes and modifications may be aimed, therefore, to cover in the appended claims all such changes and modifications as fall within the true spirit and scope

of the invention.

Claims

1. A navigation system (1) comprising:
   a position sensor (3) for detecting a present position information upon receipt of a radio wave from a satellite;
   operation means (5) for designating the operation from external;
   navigation control means (41) for calculating a present position corresponding to a control signal from said operation means (5), and a position information signal output from said position sensor (3), and generating control signals;
   reproducing means (10) to be controlled by said control signals of said navigation control means (41) and for reproducing a map data which has been recorded preliminarily in a first area (30) of a optical disc (7), and a data recorded in a second area (31) of said optical disc;
   recording means (10) to be controlled by said control signal of said navigation control means (41) and for recording a data from said navigation control means in said second area (31) of optical disc (7); and
   display means (2) for displaying a predetermined display image in accordance with a reproducing signal obtained from said reproducing means and a position information obtained from said navigation control means.

2. A navigation system (1) according to claim 1, wherein said data to be recorded in the second area (31) is any one of locus, symbol, recorded date and time, voice, or image.

3. A navigation system (1) according to claim 1, wherein said data to be recorded in the second area (31) is referred to said data which has been recorded preliminarily in the first area (30).

4. A navigation system (1) according to claim 1, wherein said data to be recorded in the second area (31) includes an address information on the disc of said data which has been recorded preliminarily in the first area (30) as a data.

5. A navigation system (1) according to claim 1 wherein said data to be recorded in the second area (31) includes and records any one of which at least, the latitude and longitude of said map information which has been recorded preliminarily in the first area (30), and the recorded date and time.

6. A recording medium wherein:
   a management area for managing map information is formed at a first area (30) which has been recorded preliminarily a map information, and at a part of said first area; and
   a management area for managing a data in relation to said map information which is formed at a second area (31) to be recorded a data in relation to said map information, and a part of said second area.

7. A recording medium according to claim 6, wherein said data to be recorded in the second area (31) is any one of locus, symbol, recorded date and time, voice, or image.

8. A recording medium according to claim 6, wherein said data to be recorded in the second area (31) is referred to said data which has been recorded preliminarily in the first area (30).

9. A recording medium according to claim 8, wherein said data to be recorded in the second area (31) includes an address information on the disc of said data which has been recorded preliminarily in the first area (30).

10. A recording medium according to claim 8, wherein said data to be recorded in the second area (31) includes and records at least any one of the latitude and longitude of said map information has been recorded preliminarily in the first area (30), and the recorded date and time.

11. A reproducing method for a navigation system which comprises:
   a position sensor (3) for detecting a present position information upon receipt of a radio wave from a satellite;
   operation means (5) for designating the operation from external;
   navigation control means (41) for calculating a present position corresponding to a control signal from said operation means, and a position information signal output from said position sensor, and generating control signals;
   reproducing means (10) to be controlled by said control signal of said navigation control means and for reproducing a map data which has been recorded preliminarily in a first area of a optical disc, and a data recorded in a second area of said optical disc; and
   display means (2) for displaying a predetermined display image in accordance with a reproducing signal obtained from said reproducing means and a position information obtained from said navigation control means;
   said reproducing method comprising the steps of:

discriminating whether or not a mode for displaying a data recorded in a second area (31);

reading a data corresponding to said map information read from the first area (30) from said second area, when judged the mode for displaying the data recorded in the second area; and

displaying said read data on said display means.

12. A reproducing method according to claim 11, wherein said data recorded in the second area (31) includes and reads an address information of said map information corresponding to said data recorded in the first area (30).

13. A reproducing method according to claim 11, wherein said data recorded in the second area (31) includes and records at least any one of the latitude and longitude of said map information corresponding to said data recorded in the first area (30), and the recorded date and time.

14. A reproducing method for a navigation system which comprises:

a position sensor (3) for detecting a present position information upon receipt of a radio wave from a satellite;

operation means (5) for designating the operation from external;

navigation control means (41) for calculating a present position corresponding to a control signal from said operation means, and a position information signal output from said position sensor, and generating control signals;

reproducing means (10) to be controlled by said control signal of said navigation control means and for reproducing a map data which has been recorded preliminarily in a first area of a optical disc, and a data recorded in a second area of said optical disc;

recording means (10) to be controlled by said control signal of said navigation control means and for recording a data from said navigation control means in said second area of optical disc; and

display means (2) for displaying a predetermined display image in accordance with a reproducing signal obtained from said reproducing means and a position information obtained from said navigation control means;

said reproducing method comprising the steps of:

determining whether or not to record the data in the second area (31); and

adding a data corresponding to said map information read from said first area to said data when determined to record the data in the second area by said step, and recording it to said optical disc.

15. A reproducing method according to claim 14, wherein said data recorded in the second area (31) includes and records an address information of said map information corresponding to said data and recorded in the first area (30).

16. A reproducing method according to claim 14, wherein said data recorded in the second area (31) includes and records at least any one of the latitude and longitude of said map information corresponding to said data and recorded in the first area (30), and the recorded date and time.

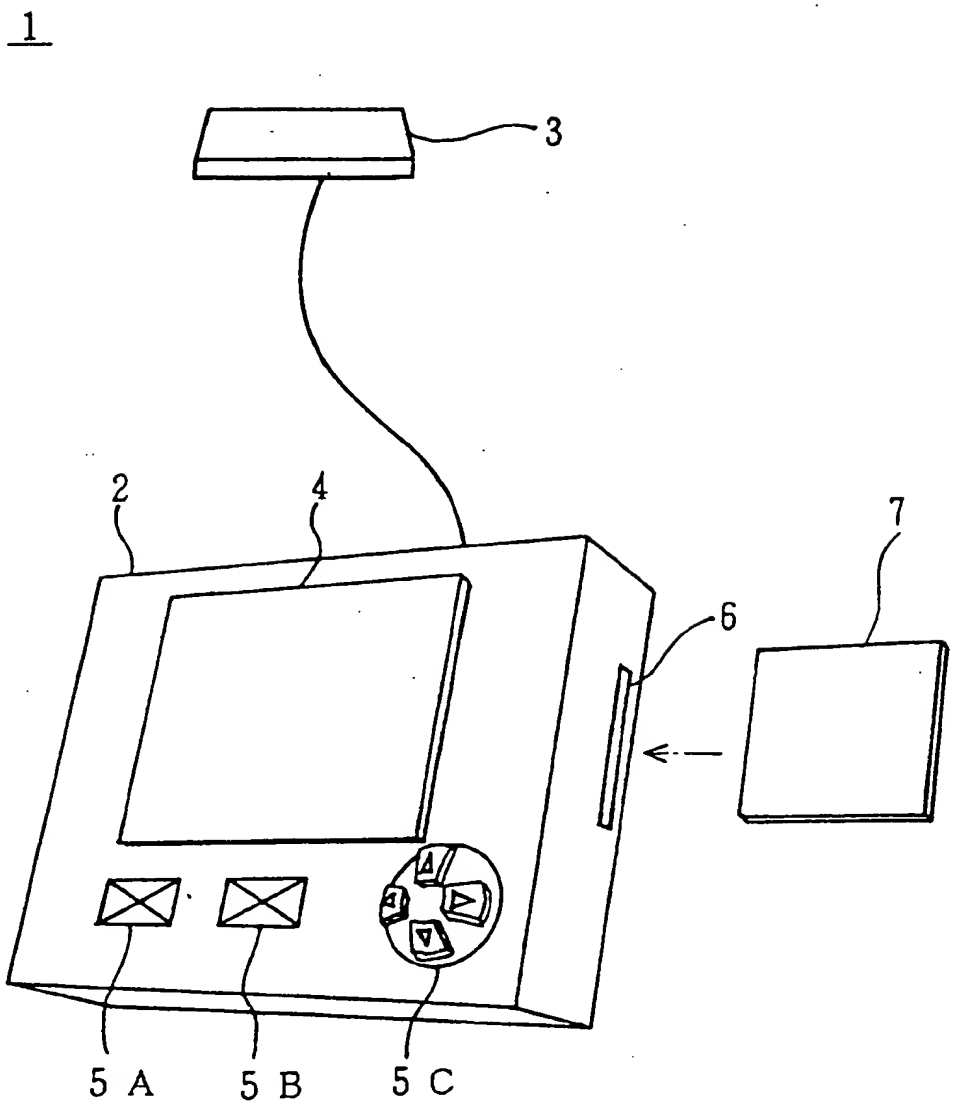

FIG. 1

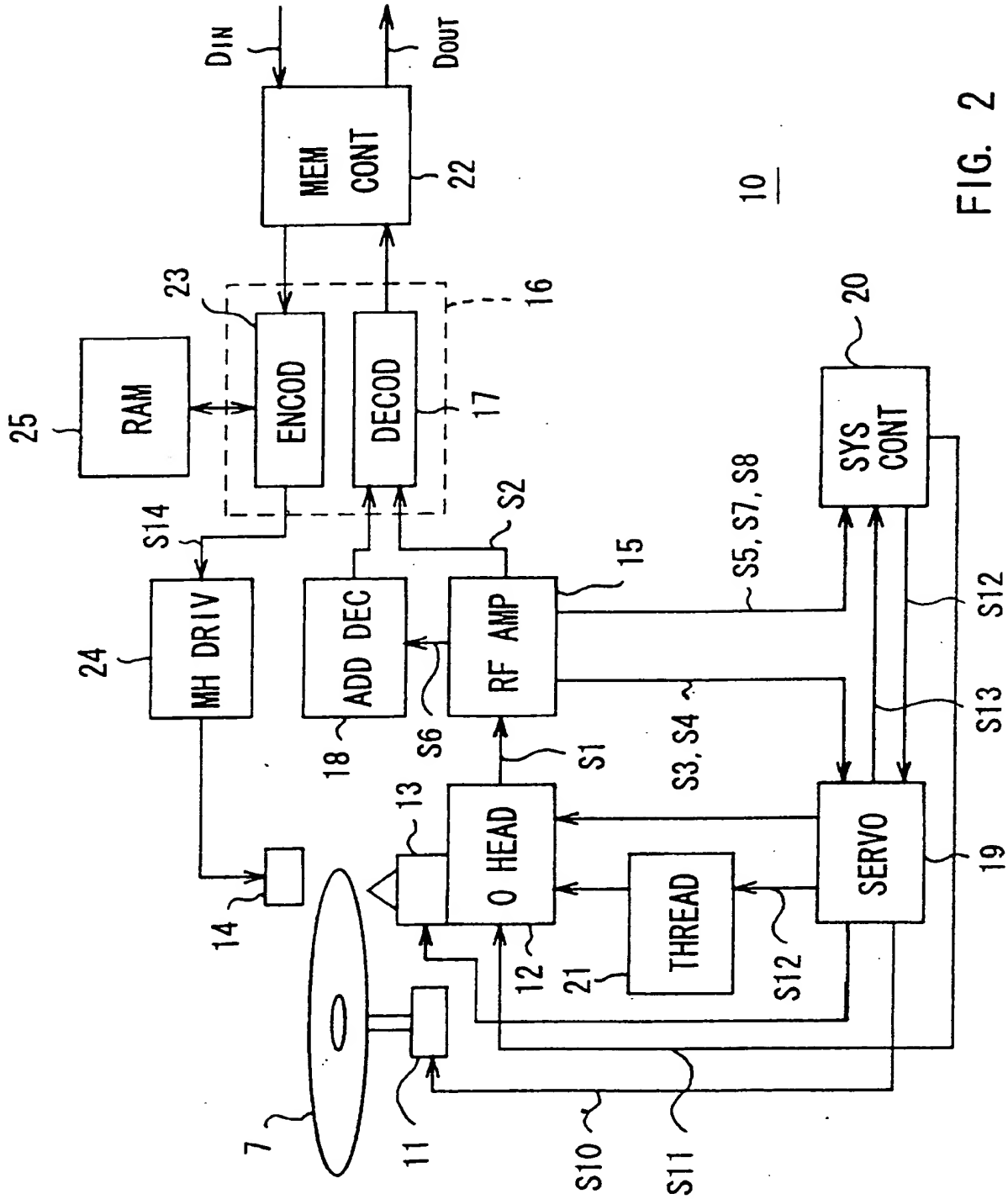
DIN
DOUT
MEM CONT
22
23
16
RAM
ENCOD
DECOD
17
25
20
SYS CONT
S14
S2
S5, S7, S8
15
MH DRIV
ADD DEC
RF AMP
S12
24
18
S6
S1
S3, S4
S13
13
O HEAD
SERVO
19
14
12
21
THREAD
S12
7
11
S10
S11
10

FIG. 2

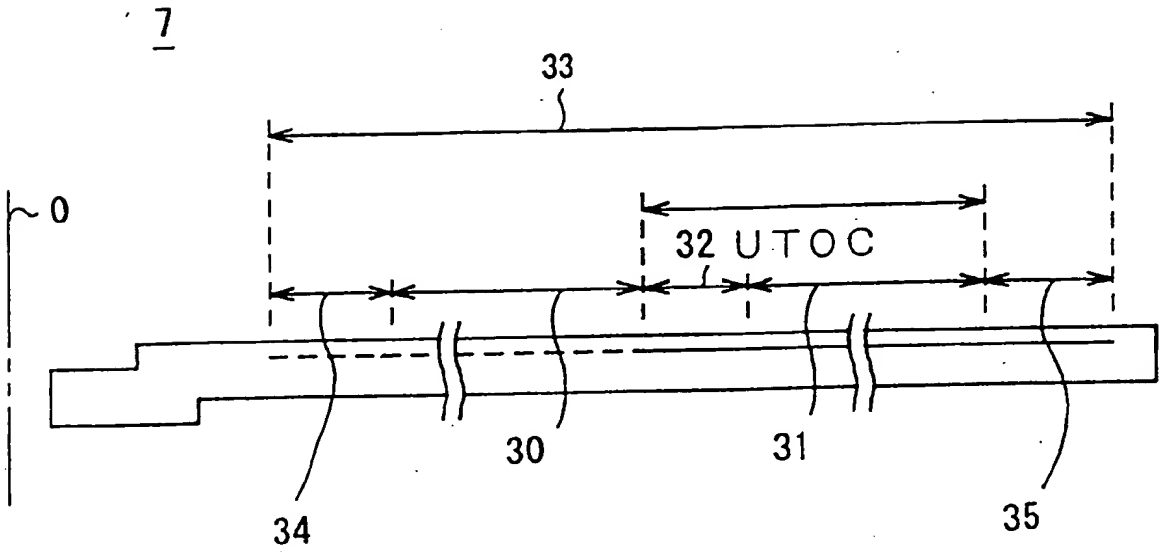
7
33
0
32 UTOC
30
31
34
35

FIG. 3

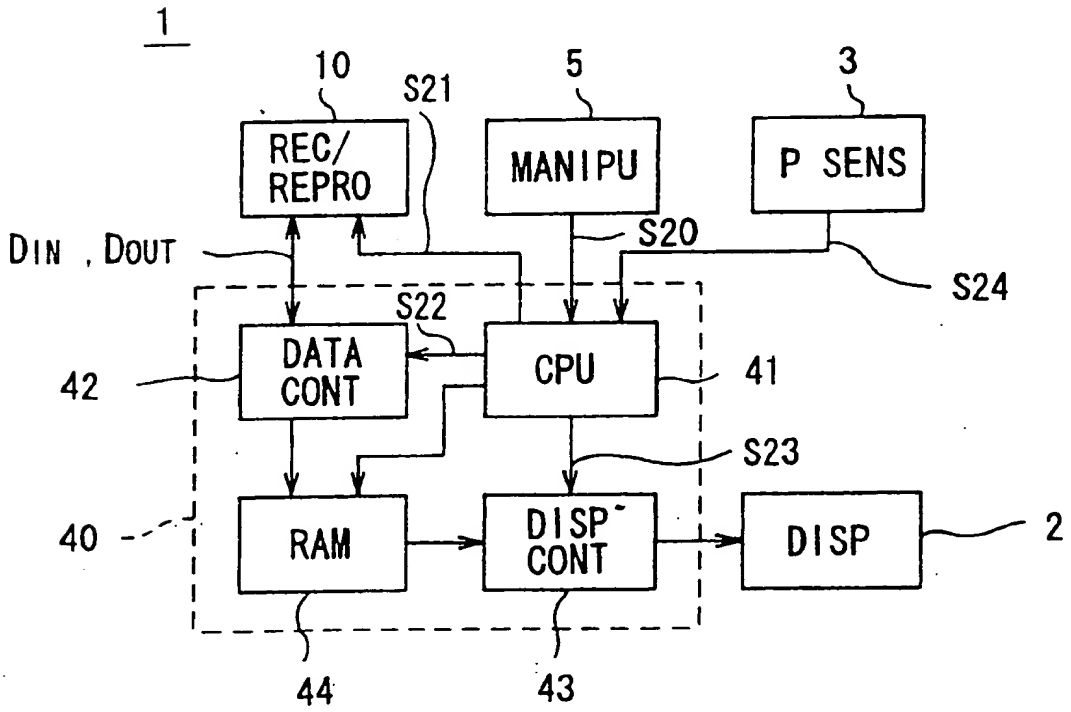
1
10
S21
5
3
REC/
REPRO
MANIPU
P SENS
DIN , DOUT
S20
S24
S22
DATA
CONT
CPU
42
41
S23
40
RAM
DISP
CONT
DISP
2
44
43

FIG. 6

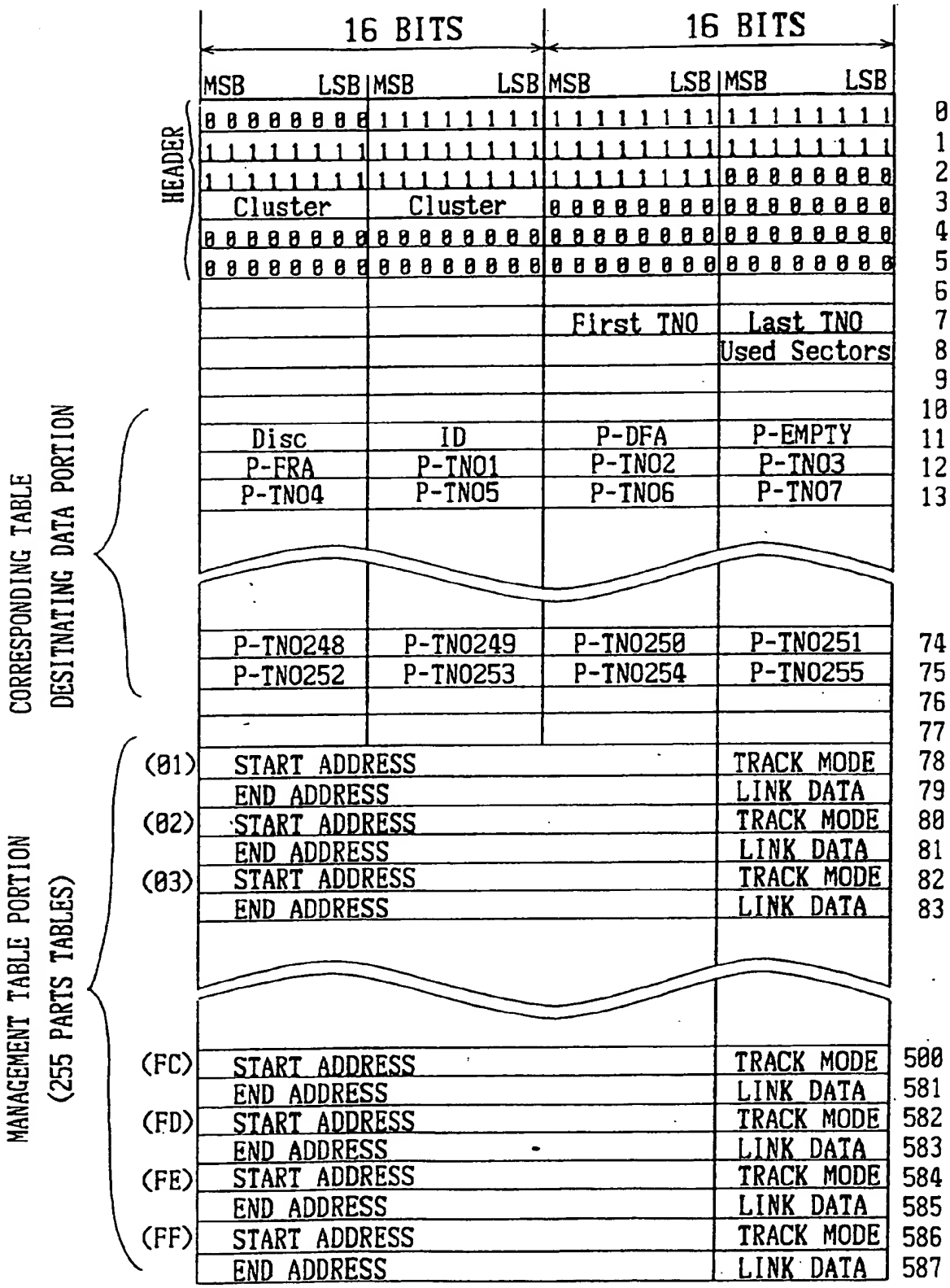
16 BITS
16 BITS
MSB LSB MSB LSB MSB LSB MSB LSB
HEADER
0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 2
Cluster Cluster 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 3
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 4
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 5
6
First TNO Last TNO 7
Used Sectors 8
9
10
CORRESPONDING TABLE DESITNATING DATA PORTION
Disc ID P-DFA P-EMPTY 11
P-FRA P-TNO1 P-TNO2 P-TNO3 12
P-TNO4 P-TNO5 P-TNO6 P-TNO7 13
P-TNO248 P-TNO249 P-TNO250 P-TNO251 74
P-TNO252 P-TNO253 P-TNO254 P-TNO255 75
76
77
MANAGEMENT TABLE PORTION (255 PARTS TABLES)
(01) START ADDRESS TRACK MODE 78
END ADDRESS LINK DATA 79
(02) START ADDRESS TRACK MODE 80
END ADDRESS LINK DATA 81
(03) START ADDRESS TRACK MODE 82
END ADDRESS LINK DATA 83
(FC) START ADDRESS TRACK MODE 500
END ADDRESS LINK DATA 581
(FD) START ADDRESS TRACK MODE 582
END ADDRESS LINK DATA 583
(FE) START ADDRESS TRACK MODE 584
END ADDRESS LINK DATA 585
(FF) START ADDRESS TRACK MODE 586
END ADDRESS LINK DATA 587

FIG. 4

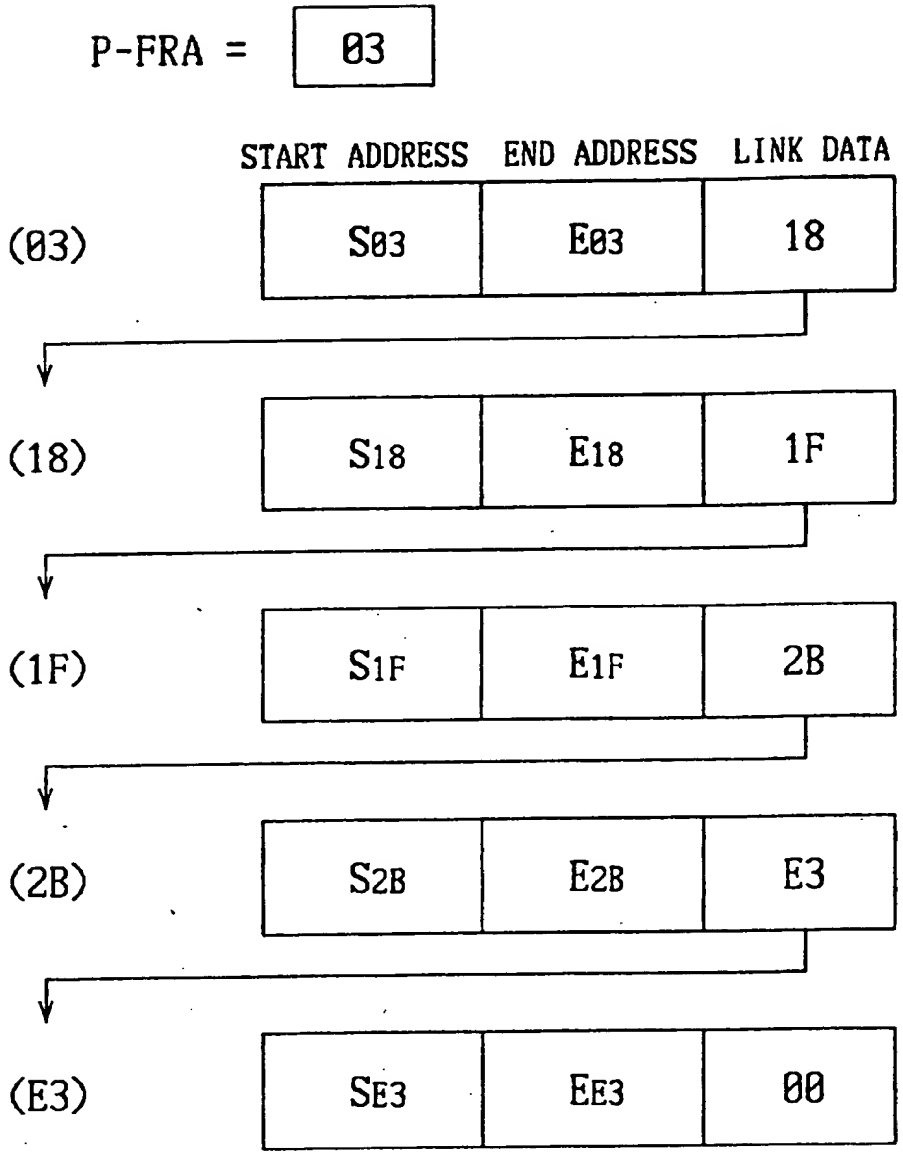
P-FRA =
03
START ADDRESS
END ADDRESS
LINK DATA
(03)
S03
E03
18
(18)
S18
E18
1F
(1F)
S1F
E1F
2B
(2B)
S2B
E2B
E3
(E3)
SE3
EE3
00

FIG. 5

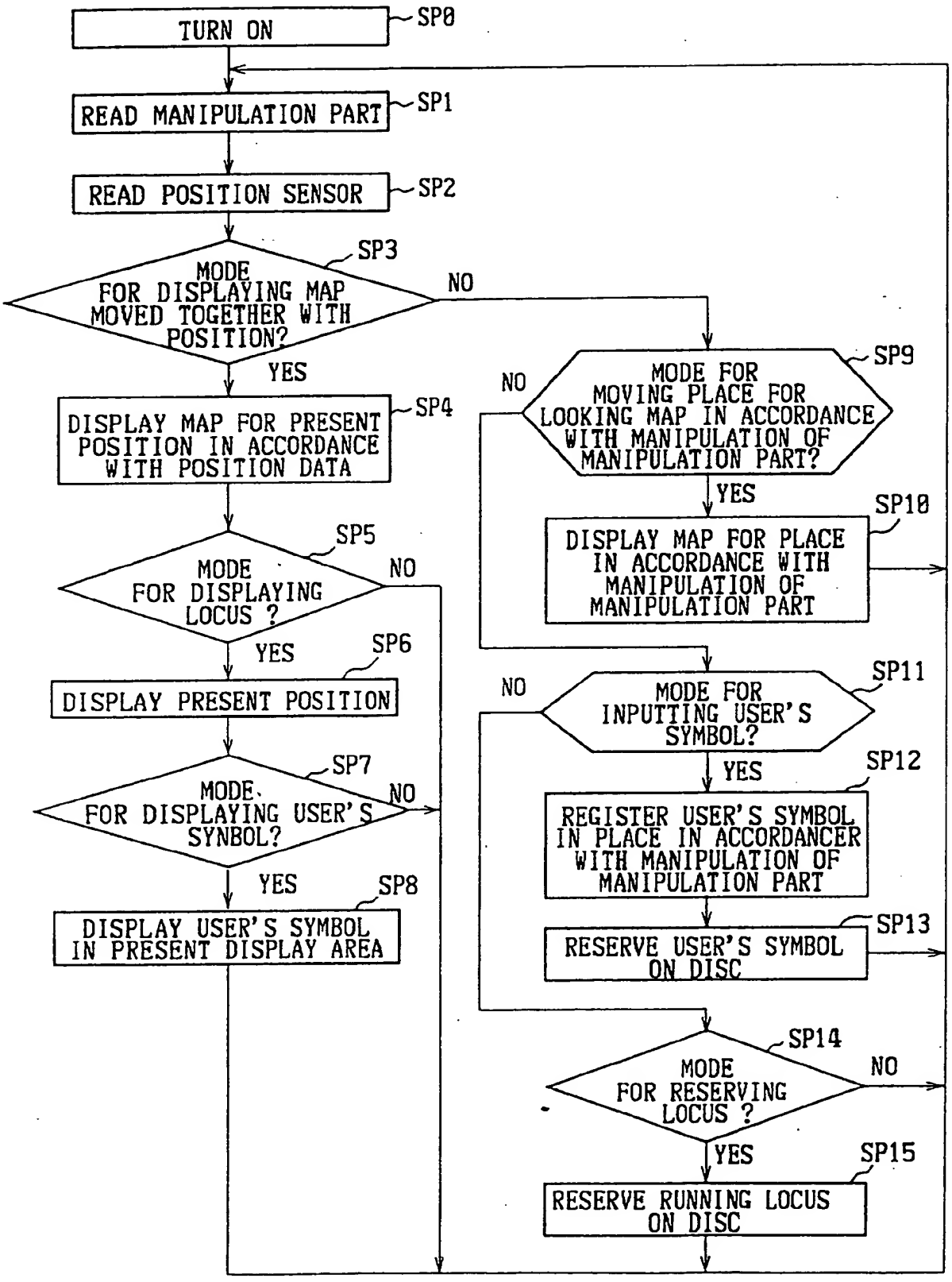
TURN ON
SP0
READ MANIPULATION PART
SP1
READ POSITION SENSOR
SP2
MODE FOR DISPLAYING MAP MOVED TOGETHER WITH POSITION?
SP3
NO
YES
DISPLAY MAP FOR PRESENT POSITION IN ACCORDANCE WITH POSITION DATA
SP4
MODE FOR DISPLAYING LOCUS ?
SP5
NO
YES
DISPLAY PRESENT POSITION
SP6
MODE FOR DISPLAYING USER'S SYNBOL?
SP7
NO
YES
DISPLAY USER'S SYMBOL IN PRESENT DISPLAY AREA
SP8
MODE FOR MOVING PLACE FOR LOOKING MAP IN ACCORDANCE WITH MANIPULATION OF MANIPULATION PART?
SP9
NO
YES
DISPLAY MAP FOR PLACE IN ACCORDANCE WITH MANIPULATION OF MANIPULATION PART
SP10
MODE FOR INPUTTING USER'S SYMBOL?
SP11
NO
YES
REGISTER USER'S SYMBOL IN PLACE IN ACCORDANCER WITH MANIPULATION OF MANIPULATION PART
SP12
RESERVE USER'S SYMBOL ON DISC
SP13
MODE FOR RESERVING LOCUS ?
SP14
NO
YES
RESERVE RUNNING LOCUS ON DISC
SP15

FIG. 7

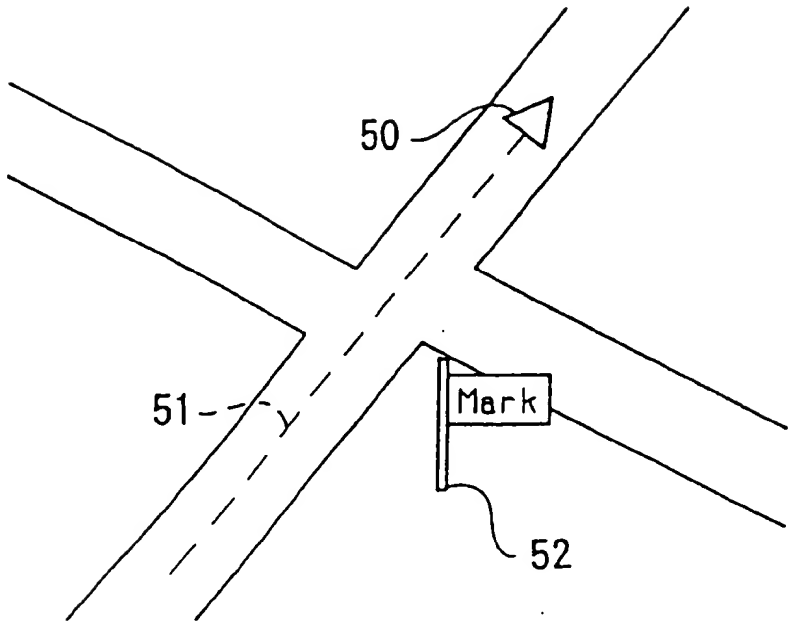
50
51
Mark
52

FIG. 8

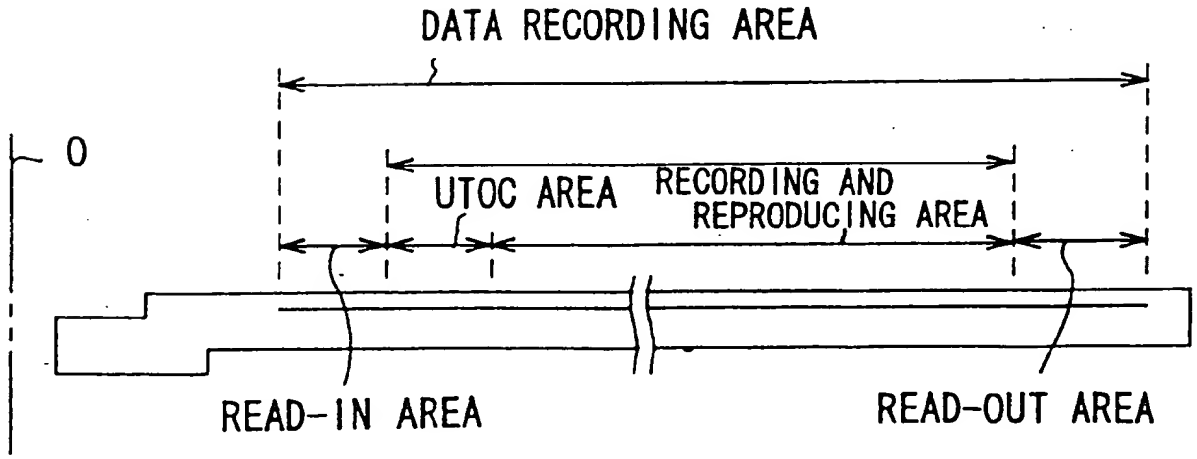
DATA RECORDING AREA
0
UTOC AREA
RECORDING AND
REPRODUCING AREA
READ-IN AREA
READ-OUT AREA

FIG. 9

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 93 12 0955

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
D,Y	US-A-4 571 684 (TAKANABE ET AL.) * the whole document *	1-16	G01C21/20 G11B27/32
Y	EP-A-0 346 979 (N.V. PHILIPS' GLOEILAMPENFABRIEKEN) * page 6, line 7 - page 8, line 35; figures 2-4 *	1-16	
A	GB-A-2 157 035 (OLYMPUS OPTICAL CO.LTD.) * page 3, line 23 - line 58; figure 8 *	1	
A	EP-A-0 431 590 (HITACHI LTD.) * page 15, left column, line 21 - line 43 * * page 10, left column, line 11 - line 13; figures 1,21 *	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.5)

G01C
G11B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	22 March 1994	Hoekstra, F

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)